PRELIMINARY

Deep Space Test Bed
SDC

Specification
And
User's Manual

December 2004

Document Scope

A Smart Data Connector (SDC) will be the interface between the Flight Control & Data System (FCDS) and an experiment on the Deep Space Test Bed (DSTB) long duration balloon flight.

This manual describes the functional and physical characteristics of the SDC.

System Definition

General Functional Description

Each experiment on the DSTB will be furnished a SDC. The SDC consists of a Netburner 5272 SB72IO module, which is based on the Motorola 5272 Coldfire processor running at 66 MHz, and a custom carrier board that provides power conditioning, state sensors, and interface circuitry. The SDC will package serial and sensor data and transmit to the FCDS over a 100baseT network interface.

In typical operation the SDC will receive data from an experiment through an asynchronous serial port, buffer and package the data, and transmit the data to the FCDS for storage or transmission to the ground control center. Commands to an experiment will be handled in a similar manner. Commands will be received via telemetry by the FCDS, transmitted to a specific SDC over the 100baseT network and then transmitted to the experiment by serial port.

In addition to handling experiment communications each SDC will be able to make independent state measurements of temperature or voltage and provide a limited number of control relays and general-purpose I/O bits.

SDC power consumption will be approximately 3.5 watts. SDCs will receive primary bus voltages of +28VDC and condition as required.

Abbreviated System Specifications

Communcications:

Two independent asynchronous serial ports cable of operating at standard baud rates up to 115.2 kbaud

100 baseT network with static IP addressing

Temperature Sensors:

Seven temperature measurements external to the SDC enclosure and one temperature measurement internal to the SDC enclosure all with a range of -55°C to +125° C and accuracy of 2° C over the full range.

Digital I/O:

Four input bits compatible with AHC logic with 10K pullup resistors to +5V
Three high current output bits capable of sourcing 64mA and sinking 32 mA
One general-purpose output bit compatible with AHC logic levels.

Relays:

Three latching relays each capable of switching 1 amp of current at up to 30VDC.

Analog Inputs

Two differential analog inputs with 0 to 4.5V input range and 10 bit resolution.
Default gain of 1, other gains available upon request.

Power:

+18VDC to +36VDC input, 3.5 Watts

Dimensions:

7.40” x 7.40” x 2.50”

Weight:

1.2 kg

Electrical Interface

System Power and Grounding

The SDC operates on an input voltage of 18 Volts DC to 36 Volts DC with a nominal power consumption of 3.5 Watts. Reverse voltage protection is provided. Nominal input voltage is expected to be +28VDC. Jumper S1 connects input ground to board ground. Removal of Jumper S1 'floats' board ground relative to the input +28VDC. See 'Deep Space Test Bed Grounding Plan' for further information regarding system grounding.

Name: J1
Description: input voltage +18VDC to +36VDC
Box Connector: PT02A-10-6P, (MS3112), MIL-C-26482, Series 1
Mating Cable Connector: PT06A-10-6S (SR), (MS3116), MIL-C-26482, Series 1

Pin Number	Description
A	+28VDC
B	+28VDC
C	Not used
D	Return +28VDC
E	Return +28VDC
F	Not used

Table 1

Serial Communications

Two independent asynchronous serial ports are provided. Baud rates of up to 115.2 kbaud are supported as shown in Table 2. Baud rates are selected through software control. Selecting the appropriate S2 jumper configuration as shown in Tables 3 and 4 supports interface protocols RS-232 or RS-422.

Serial Port 1 (COM1) Baud Rates	Serial Port 2 (COM2) Baud Rates
2400	2400
9600	9600
19200	19200
38400	38400
115200	115200

Table 2

Serial Port 1	SW1	SW2	SW3
RS422	OFF	ON	ON
RS232	ON	OFF	ON

Table 3

Serial Port 2	SW4	SW5	SW6
RS422	OFF	ON	ON
RS232	ON	OFF	ON

Table 4

Both RS232 and RS422 signals are brought to the enclosure DB9 connectors. Unused pins are high impendence based on the protocol selected in Tables 3 or 4.

Name: J2
Description: serial port 1
Box Connector: DB9 pin, MIL-DTL-M24308/4
Mating Cable Connector: DB9 socket, MIL-DTL-M24308/2

Pin Number	Description
1	RS422 RX+
2	RS232 RX
3	RS232 TX
4	RS422 TX+
5	Signal GND
6	RS422 RX-
7	RS232 RTS
8	RS232 CTS
9	RS422 TX-

Table 5

Name: J3
Description: serial port 2
Box Connector: DB9 pin, MIL-DTL-M24308/4
Mating Cable Connector: DB9 socket, MIL-DTL-M24308/2

Pin Number	Description
1	RS422 RX+
2	RS232 RX
3	RS232 TX
4	RS422 TX+
5	Signal GND
6	RS422 RX-
7	RS232 RTS
8	RS232 CTS
9	RS422 TX-

Table 6

Temperature Sensor and Analog Inputs

Each SDC can measure eight AD590 temperature sensors. Seven sensor connections are on connector J4 with one sensor being used internal to the enclosure. Temperature information will be read every TBD seconds and communicated to the FCDS as part of a housekeeping packet describing the SDC state. This packet may or may not be sent to the ground during the flight depending on the experiment requirements and available bandwidth. AD590 temperature sensors will be furnished to the experiments with the SDC. The AD590 sensor range is -55°C to +125°C with a resolution of 0.3° C and accuracy of 2° C.

Each SDC has four differential input analog channels. Two channels are brought to the J4 connector with one channel being used internal to the enclosure and one channel available upon request. Channels 1 & 2 have 30 VDC over voltage protection. Channel 3 input voltage should not exceed ±5.3 VDC. Channels 1 & 2 have 400 Hz input filters and may be used at higher gains without rectification of the input signal. Channel 3 frequency response is 15 kHz at a gain of 1. Channel 1 & 2 gains may be adjusted from 1 to 1000. Default value is 1.

Name: J4
Description: temperature sensors & analog input
Box Connector: PT02A-14-19P, (MS3112), MIL-C-26482, Series 1
Mating Cable Connector: PT06A-14-19S (SR), (MS3116), MIL-C-26482, Series 1

Pin Number	Description
A	Signal GND
B	Analog input 1+
C	Analog input 1-
D	Analog input 2+
E	Analog input 2-
F	AD590 temperature sensor 7-
G	AD590 temperature sensor 7+
H	AD590 temperature sensor 6-
J	AD590 temperature sensor 6+
K	AD590 temperature sensor 5-
L	AD590 temperature sensor 5+
M	AD590 temperature sensor 4-
N	AD590 temperature sensor 4+
P	AD590 temperature sensor 3-
R	AD590 temperature sensor 3+
S	AD590 temperature sensor 2-
T	AD590 temperature sensor 2+
U	AD590 temperature sensor 1-
V	AD590 temperature sensor 1+

Table 7

Relay Switching

Three latching relays are provided for general purpose switching of loads up to 1 amp. Relays are set or reset either by software commands from the FCDS or by algorithms internal to the SDC CPU. An example would be having a relay programmed to set or reset based on a temperature sensor set point. The state of each relay is included in the SDC housekeeping packet. For cabling purposes relays 1 & 2 have an internally connected pin that may be used for ground continuity. This pin is isolated from the board ground. Switching capacity is 1 amp at 30VDC.

Name: J5
Description: relay input and output
Box Connector: PT02A-12-10P, (MS3112), MIL-C-26482, Series 1
Mating Cable Connector: PT06A-12-10S (SR), (MS3116), MIL-C-26482, Series 1

Pin Number	Description
A	Relay 3 signal input
B	Relay 3 signal output
C	Relay 3 pass through signal
D	Relay 3 pass through signal
E	Relay 2 signal input
F	Relay 2 signal output
G	Relay 2 pass through signal
H	Relay 2 pass through signal
J	Relay 1 signal input
K	Relay 1 signal output

Table 8

Digital I/O

Four general purpose input bits and four general-purpose output bits are provided. Output bits 1-3 are high current source (32mA) with bit 4 being able to source 8 mA of current. Input bits 1-4 have pullup resistors to VCC and are suitable for sensing switch closures, etc. Inputs are AHC logic compatible.

Name: J6
Description: digital input & output
Box Connector: PT02A-12-10S, (MS3112), MIL-C-26482, Series 1
Mating Cable Connector: PT06A-12-10P (SR), (MS3116), MIL-C-26482, Series 1

Pin Number	Description
A	Output Bit 1, 32 mA source, 64 mA sink
B	Output Bit 2, 32 mA source, 64 mA sink
C	Output Bit 3, 32 mA source, 64 mA sink
D	Output Bit 4, 8 mA source, 8 mA sink
E	Input Bit 1 with pullup resistor to VCC
F	Input Bit 2 with pullup resistor to VCC
G	Input Bit 3 with pullup resistor to VCC
H	Input Bit 4 with pullup resistor to VCC
J	DEBUG USE ONLY
K	Signal GND

Table 9

Network

A 100 baseT network interface is used to connect each SDC to the DSTB FCDS and for debugging purposes. Magnetic isolation of 1500 Vrms is provided.

Name: J7
Description: network connection
Box Connector: PT02A-8-4P, (MS3112), MIL-C-26482, Series 1
Mating Cable Connector: PT06A-8-4S (SR), (MS3116), MIL-C-26482, Series 1

Pin Number	Description
A	TX+
B	TX-
C	RX+
D	RX-

Table 10

Mechanical Interface

Each SDC measures 7.40” x 7.40” x 2.50” and may be mounted in any orientation that provides access to electrical interface connectors.

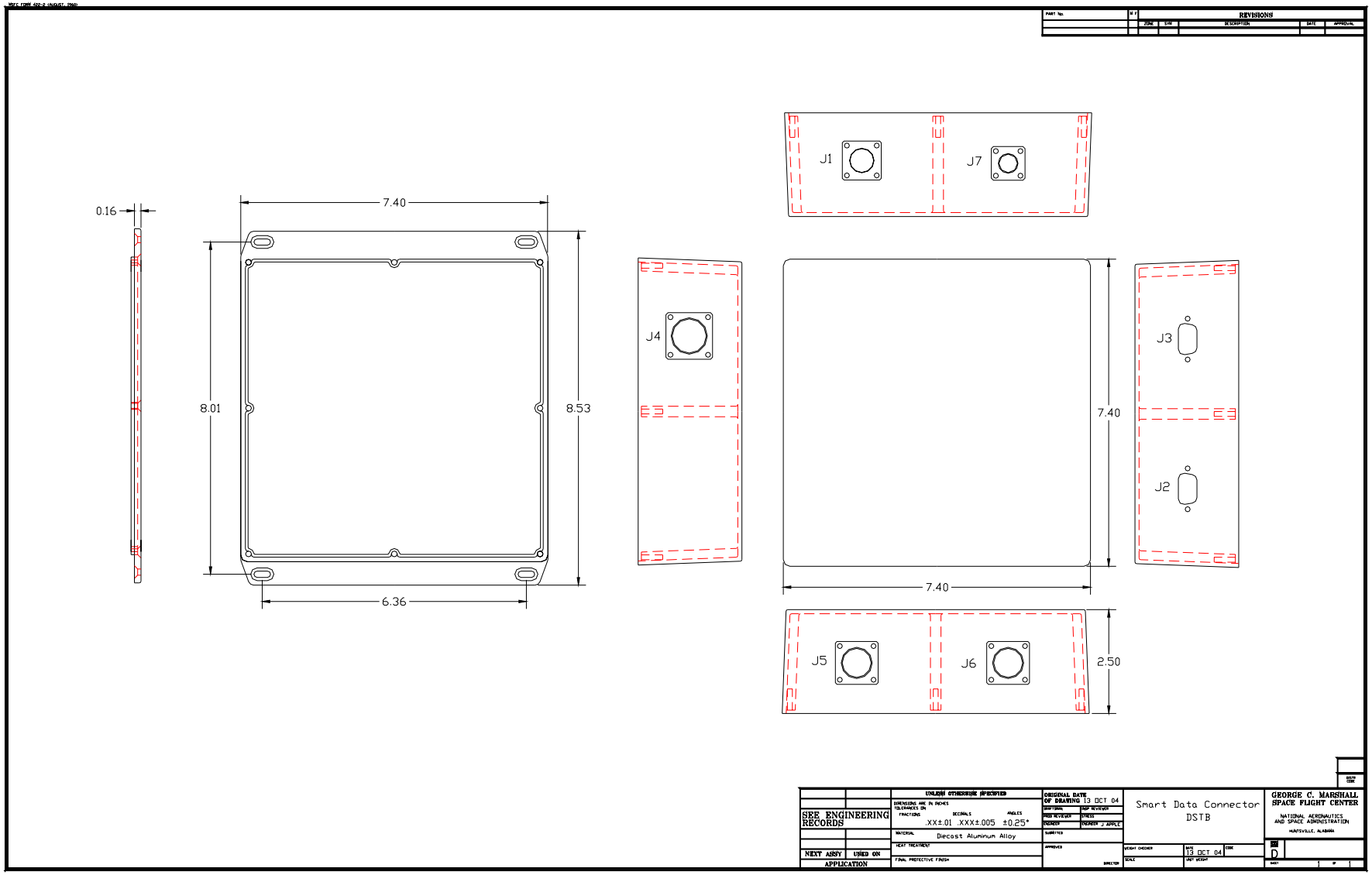
Software Interface

Upon powering a SDC will initialize the two experiment serial ports to an experiment defined baud rate and wait to receive data from the experiment. When data is received it will be packaged and transmitted to the FCDS for storage or transmission to the ground. Other I/O bits or relays will be initialized per experiment requirements.

Each SDC will communicate a housekeeping packet describing the system state every TBD seconds to the FCDS. This packet will contain the information shown in Table 11.

SDC Housekeeping Packet Information		
Name	**Range**	**Conversion**
Internal Temperature 1	0 - 1024	Deg C = .216X - 55
Internal Temperature 2	0 - 1024	Deg C = .216X - 55
External Temperature 1	0 - 1024	Deg C = .216X - 55
External Temperature 2	0 - 1024	Deg C = .216X - 55
External Temperature 3	0 - 1024	Deg C = .216X - 55
External Temperature 4	0 - 1024	Deg C = .216X - 55
External Temperature 5	0 - 1024	Deg C = .216X - 55
External Temperature 6	0 - 1024	Deg C = .216X - 55
Relay 1 Sense	Bit	1 = Relay ON , 0 = Relay OFF
Relay 2 Sense	Bit	1 = Relay ON , 0 = Relay OFF
Relay 3 Sense	Bit	1 = Relay ON , 0 = Relay OFF
Input 1	Bit	1 = OPEN, 0 = CLOSED
Input 2	Bit	1 = OPEN, 0 = CLOSED
Input 3	Bit	1 = OPEN, 0 = CLOSED
Input 4	Bit	1 = OPEN, 0 = CLOSED
Reference Voltage	0 – 1024	V = (5/1024)X + 0 ; 2.5V nominal

Table 11


REVISIONS
0.16
7.40
8.01
8.53
6.36
J1
J7
J4
J3
J2
7.40
7.40
J5
J6
2.50
Smart Data Connector
DSTB
SEE ENGINEERING RECORDS
Diecast Aluminum Alloy
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA